ABSTRACT

REALIZATION OF A FASTER, CHEAPER, BETTER MISSION AN]) ITS NEW PARADIGM S'J'Al< TRACKER, THE ADVANCED S'1'111 .LAR COMPASS

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The first Danish satellite, Oersted, will be launched in August of 1997. The scientific objective of Oersted is to perform a precision mapping of the Earth's magnetic field. Attitude data for the payload and the satellite. are provided by the Advanced Stellar Compass (ASC) star tracker. The ASC consists of a CCD star camera and a capable microprocessor which operates by comparing the star image frames taken by the camera to its internal star catalogs.

The ASC was developed from concept to flight model in less than 3 years. It represents a new paradigm in mass, power, size and autonomy which are combined with high precision attitude determination. This accomplishment was realized by the use advanced, commercia - of-the-sl]clf electronics, custom optics of unprecedented speed, and a design philosophy of implementing the maximum possible. level of autonomy.

The ASC solves the. lost-in-space. problem by autonomously identifying the stars in its ficl(i-of-view (1 'OV) within 1 sec of reading any star field over the whole sky. It then automatically tracks all stars in its 1 'OV which are brighter than its detection threshold at late.s up to 3 deg per sec.

The number of stars tracked is typically 65, but this depends (m pointing direction and varies from 25 to a maximum of 200." Since usual instruments only track 210 10 stars, the ASC significantly improves the accuracy of pointing knowledge, vis-à-vis conventional units, by statistically averaging many more data points from each image frame. The pointing direr.tion of the ASC is reported as an attitude quaternion which is referenced to the firmament, rather than as star image centroids which are referenced to the CC]) sensor.

Since all of the identification, tracking, referencing, and data correction functions are done internally, and the flow of data is greatly mimed, the processing load on the central computer is dramatically reduced by the autonomous operation of the ASC.

Real sky evaluation and calibration of the ASC have been done at '1'able Mountain, CA and at University of 1 Iawaii observatories at Mauna Kea, I Ii in June of 1996. The superior viewing conditions on Mama Kea made it possible to explore the ASC limits of performance. A single axis, R MS, relative accuracy of 1.2 aresec was confirmed with the miniature, flight camera head.